IN THE SPECIFICATION

Please amend the Specification at paragraphs 11, 13, 28-32, and 34, respectively, as follows:

In accordance with one aspect of the invention, a method of clinical imaging is disclosed that includes exciting water-exchangeable spins in oxygen-~~bearing~~bearable molecules in a ROI having a change in oxygen status. The method includes detecting proton transfer within the ROI from exchangeable protons within water and determining changes in oxygen levels across the ROI.

In accordance with another aspect, the invention includes a MRI apparatus including a MRI system having a plurality of gradient coils positioned about a bore of a magnet to impress a polarizing magnetic field and an RF transceiver system and an RF switch controlled by a pulse module to transmit RF signals to an RF coil assembly to acquire MR images. The MRI apparatus also includes a computer programmed to cause application of a pulse sequence to excite oxygen-~~bearing~~bearable molecules within a ROI having a change in oxygenation, acquire MR data from directly imageable molecules having been influenced by the oxygen-~~bearing~~bearable molecules, and reconstruct an image from the MR data to illustrate a change in oxygen debt across the ROI.

After selection 110, the ROI is irradiated with the selected exchangeable resonance 112. That is, the selected exchangeable resonance is applied to the ROI to excite water-exchangeable spins in heme-proteins, particularly oxygen-~~bearing~~bearable or oxygen-carrier molecules. More specifically, the irradiation of heme-protein exchangeable resonance at a level optimized for reduction of a water signal is continued 114. As such, the spin state of the protons of the heme-proteins is excited such that it is transferred to and accepted by imageable molecules, typically imageable water molecules. As such, this process may be referred to as a proton transfer or water transfer effect.

The reduction of the water signal is measured 116 and irradiation of the ROI is repeated at a non-heme protein resonance frequency 118 in order to measure an MT effect 120. ~~—~~The data gathered from the ROI during the irradiations is recorded as a difference water image or spectral data 122. The acquired MR data is then reconstructed to form an image 12~~4~~0 in accordance with well-known image reconstruction techniques. From the reconstructed image 12~~4~~0, it is possible

to determine oxygenation changes across the ROI 12~~6~~2. That is, a determination in the change in local oxygen levels is made via the change in water detected deoxy-hemoglobin or deoxy-myoglobin exchange. As such, the imaging technique yields a reconstructed image that illustrates oxygenation debt across the ROI.

To further distinguish these differences in oxygenation, the data may be adjusted or weighted after reconstruction based on oxygenation 12~~4~~0. Therefore, a spatial distribution of oxygen debt across the ROI results and provides enhanced contrast between oxygen depleted and oxygen-rich regions in the ROI.

For example, utilizing an exchangeable proton off-resonance, myoglobin, upon oxygenation, becomes diamagnetic and a signal from the myoglobin is shifted from the frequency of the selective irradiation. It is contemplated that one preferred target is the histidine NH, which in the doxy myoglobin state, is shifted to approximately 75 ppm downfield of water. As such a proton spectrum range is contemplated of approximately 10-80 ppm. Accordingly, upon review of the reconstructed exchangeable proton weighted image 12~~4~~0, it is possible to identify a region experiencing myoglobin oxygen debt because data from the oxygen rich myoglobin is absent in the reconstructed image 12~~6~~2. As such, a direct sensitive measure of oxygen debt or concentration across the ROI may be made, for example, in the brain, muscle tissue, cardiac region, or other anatomical region. That is, the above-described technique provides a relatively direct means for illustrating a spatial distribution of oxygen debt through imaging of molecules influenced by a proton transfer from the otherwise non-imageable molecules or tissues.

Therefore, in accordance with one embodiment aspect of the invention, a method of clinical imaging is disclosed that includes exciting water-exchangeable spins in oxygen-~~bearing~~bearable molecules in a ROI having a change in oxygen status. The method includes detecting proton transfer within the ROI from exchangeable protons within water and determining changes in oxygen levels across the ROI.

In accordance with another embodiment of the invention, an MRI apparatus is disclosed including a MRI system having a plurality of gradient coils positioned about a bore of a magnet to impress a polarizing magnetic field and an RF transceiver system and an RF switch controlled by a pulse module to transmit RF signals to an RF coil assembly to acquire MR images. The MRI apparatus also includes a computer programmed to cause application of a pulse sequence to

excite oxygen-~~bearing~~bearable molecules within a ROI having a change in oxygenation, acquire MR data from directly imageable molecules having been influenced by the oxygen-~~bearing~~bearable molecules, and reconstruct an image from the MR data to illustrate a change in oxygen debt across the ROI.